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Water Contamination, Sanitation Practices, and Public Health Risks: A Cross-Sectional Study

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Abstract

Contaminated water remains one of the biggest obstacles to public health, especially in developing countries, partly due to a lack of sanitation systems and lack of knowledge about the dangers. This paper describes the causes of water resource contamination and the ways in which they are transmitted, the lack of knowledge of the public, and what can be done to make it less of a problem, including a cross-sectional study of 31 people living in urban, semi-urban, and rural locations in India. The research shows that the main causes of waterborne diseases are living (bacteria, viruses, parasites) and non-living (heavy metals, industrial waste) and political water contaminants. 87.1% of the respondents are aware of untreated water as a transmitter of diseases, and 96.8% are aware of the health risks associated with irresponsible disposal of waste. Other serious gaps include a 50% waste separation practice and the aforementioned lack of water tank servicing. This study shows the need for systems that are combined with the strategy. The research shows wide acceptance of the need for WASH (Water, Sanitation, and Hygiene) programs as a strategy for improving the health of the public. Combined with a strategy for improving the health of the public, this study shows the wide acceptance of the need for WASH (Water, Sanitation, and Hygiene) programs as a strategy for improving the health of the public.

Keywords: Community road, contaminated water and water management, government policy implementation, water safe integrated management

INTRODUCTION

Contaminated Water and Water Management and Community Road and Water Management and Community Road and Contaminated Water and Community Road and Community Road and Community Road and Contaminated [1]. Water is essential for all life, and for survival, as well as for health and hygiene and economic improvement and growth. Approximately 2 billion people lack access to basic safe drinking water services and 3.6 billion people lack basic safe sanitation services [2]. This is something that is very important to the health and sanitation of the world. The World Health Organization (WHO) reports that approximately 1.4 million people die each year because of water, sanitation, and hygiene (WASH) and 74 million DALY (disability-adjusted life years) are lost due to WASH related issues. Global WASH related deaths decreased by 66% between 1990 and 2019 [3]. However, low- and middle-income countries still have the highest rates of WASH related deaths. Waterborne and diarrheal diseases, such as cholera, diarrheal diseases, and typhoid are a part of the disease burden and kill more than 1 million people each year. Diarrheal diseases have about a 55 million DALY burdens, and there is a preventable portion of 69%. Children under the age of five are the most affected, as they contribute to 7.6% of all deaths and 7.5% of all DALY that are WASH related [4].

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The Indian Context

India is experiencing rapid urbanization and aging infrastructure. India also has a very high population density. These present challenges that are not faced by other countries when managing the safety of their water.

A concerning report has stated that in 2026 alone, over 5,500 people fell ill, and 34 died as a result of drinking water that was contaminated. This happened in multiple cities across India for the period of one year. People in some of India's biggest cities, such as Indore, Bengaluru, Delhi, Patna, and Gandhinagar have also reported many instances of being exposed to water that is contaminated. The report states that old pipes that have been around for 30 to 40 years are the main reason for the contamination. In Delhi, almost 18 percent of the water pipes are over 30 years old and many of these pipes are positioned next to and under sewage pipes. This is a serious contamination risk. The Central Ground Water Board (CGWB) 2024 report states that almost 20 percent of the nationwide water samples tested have a higher than acceptable limit of nitrates and about 3.35 percent and 9.04 percent of the samples have loose arsenic and fluoride respectively [5]. This shows that water contamination in India has multiple facets. Water contamination is a result of poor infrastructure, biological, and chemical elements. The aim of the study set forth is to help implement an evidence-based intervention.

Objective and Goals

This study aims to identify and list the agents of contamination, the pathways of how they are transmitted, and how aware the community is regarding these pathways [6]. The following are the objectives of this study:

1. To identify the current level of awareness among the general public regarding the causes water contamination and waterborne illnesses
2. To identify the current level practices in water treatment, storage, and waste disposal
3. To identify the current level of knowledge regarding the means of transmission, and measures of prevention
4. To identify the current level of knowledge of the risk factors associated with urban water supply systems
5. Perception of the Community Regarding the Safety of Water and the Sanitation Infrastructure

The purpose of the findings is to provide a framework and a justification for policy formulation and the design of programs to educate the community concerning health issues leading to the attainment of the sustainable development goal number 6 (Clean Water and Sanitation) [7].

REVIEW OF LITERATURE

Water contamination can be classified into three major groups: biological, chemical, and physical [8]. The nature of the contaminants poses different health risks and calls for different health intervention measures.

Biological Contamination

With biological contamination, the health risks are more imminent because many of the microorganisms cause acute waterborne diseases [9]. The WHO 2025 technical documents report on top 10 WASH pathogens concerning disease burden and transmission, and antimicrobial resistance:

- Bacterial pathogens: Diarrhea caused by and enterohemorrhagic *Escherichia coli*, *Vibrio cholerae*, *Salmonella* spp, *Shigella*, and *Campylobacter*
- Protozoan parasites: *Cryptosporidium* and *Giardia lamblia*
- Viral pathogens: Rotavirus, norovirus, adenovirus, and Hepatitis A virus

The primary indicator organism for fecal contamination is *Escherichia coli* and some of the strains (especially O157:H7) are associated with very severe cases of hemorrhagic colitis. *Vibrio cholerae*, the cholera causative agent, is endemic and, therefore, cholera outbreaks occur in places with poor

sanitation, where individuals are at risk of acute watery diarrhea and death due to severe dehydration. Epidemiological studies currently indicate 23% and 21% of waterborne disease outbreaks are due to gastrointestinal pathogens and *Shigella* species respectively. *Giardia* and *Cryptosporidium* produce cysts that survive chlorination and are only removed through more advanced filtration or UV disinfection. These parasites were found in 10.99% and 6.59% of cases of waterborne diseases, respectively [10].

Chemical Contaminants

Chemical contaminants get into the water supply through industrial discharge, agricultural runoff, and natural processes. Some common chemicals found in the water are:

- *Heavy metals:* Arsenic, lead, mercury, cadmium, and chromium. Exposure to these metals pose serious and irreversible health problems, including diseases of the brain, cancer, and developmental disorders.
- *Industrial compounds:* Organic solvents, petroleum products, and residues of pesticides and drugs.
- *Agricultural pollutants:* Fertilizers that wash into streams and rivers contain nitrates, which are fatal to young children.
- *Naturally occurring:* Fluoride (causes dental and skeletal fluorosis) and arsenic (causes arsenicosis and cancer).

Nitrate contamination shows an alarming impact of agricultural practices on groundwater resources in India's CGWB 2024 report. Chemical contamination in India is also widespread, and the report states that 20% of the groundwater samples tested positive for nitrates [11]. The largest contributors to water contamination are the discharges of industrial waste, which 93.5% of survey respondents in the present study also identified.

Physical Contaminants

Physical contaminants include: suspended solids, temperature variations, radioactivity, and turbidity. Physical contaminants are often less harmful than biological and chemical contaminants, and their presence does not indicate an immediate health risk. Physical contaminants, however, can be a site for the growth of pathogens, reduce the effectiveness of chemical disinfection, and indicate a deterioration in the overall quality of the water [12].

Transmission Pathways and Disease Burden

In the case of the transmission of various waterborne diseases, we can look at four different pathways of transmission: waterborne (illness transmitted through the drinking of contaminated water), water-washed (illnesses transmitted via poor hygiene), water-based (diseases transmitted through one or more aquatic hosts), and waters-related (illnesses transmitted through insect vectors whose larvae breed in water). In the case of transmission, the following steps occur:

1. *Contamination source:* Human/animal feces, industrial waste, agricultural runoff
2. *Environmental reservoir:* Surface and groundwater, distribution reservoir
3. *Exposure route:* Ingestion, contact, or inhalation of aerosols
4. *Human infection:* Disease manifestation (acute or chronic)
5. *Re-contamination:* Insufficient sanitation and waste management

This cyclical nature justifies the need to 'break the cycle' using integrated approaches focused on the various aspects of water quality, sanitation, and hygiene [13].

Risks of Contamination in Urban Water Supply Systems

Urban water supply systems, especially in developing nations, have multiple points of vulnerabilities:

1. *Source contamination:* Surface water contaminated with sewage and industrial waste
2. *Treatment inadequacy:* Insufficient capacity or technology to eliminate the complete spectrum of pathogens

3. *Distribution system failure:* Aging infrastructure, pipe corrosion, sewage pipe cross-connection and poor drainage systems
4. *Intermittent supply:* Negative pressure during the interruption in supply causes contamination to seep into the distribution system
5. *Contaminated storage:* Poorly maintained household storage and community storage tanks

Recent incidents of contaminated water supply systems, especially in Indian cities, illustrate the dangers of these vulnerabilities [14].

In Indore, 21 deaths took place due to sewage infiltration through damaged pipes, while more than 150 cases of typhoid due to contaminated water were reported in children in Gandhinagar [15]. Experts point out the dangers of intermittent water supply systems, as the supply break creates negative pressure, inviting pollutants into the distribution systems.

Water Safety Plans

Water Safety Plans by WHO demand multiple barriers to provide protective source capture, optimized treatment, distribution system protective, and point-of-use protection. The framework of the Water Safety Plan insists on:

- Assessment of the system to find risks and determine if the risks can be alleviated
- Operational control of the risks using some measures
- The establishment of frameworks for the management and control of the system
- Determine the water quality and the system's compliance

Point of control measures remain essential in cases where the quality of water in the pipes cannot be guaranteed. Of the survey respondents, 48.5% selected chlorination as the system that would most assist in the control of pathogenic microorganisms, and 48.5% selected boiling to promote the system for complete thermal microbial inactivation. In the case of water systems, the control of microorganisms, particularly bacteria, is done using filters with pore diameters of less than 1 micron.

Odisha's "Drink from Tap" program exemplifies the first success of 24/7 continuous pressurized water supply and reduces mix-up contamination risks [16]. The program successfully challenges the perception of tap water safety in Indian households and sets a standard for future urban water systems in India.

METHODOLOGY

Study Design

The present investigation used the cross-sectional survey-based design to determine the level of community awareness, practices, and perception related to water contamination and safety. This study sought to understand knowledge and behaviors of people across various demographics.

Study Population and Sampling

Study participants included people from urban, semi-urban, and rural parts of India. Participants were screened using online methods. Participants were selected using a set of criteria that included voluntary participation from people 18 years and older who have access to the internet and are literate. A convenience sampling method was used to meet the exploratory objectives of the study and the limitations of access.

31 participants answered the questions, which provided a diverse profile:

- *Age profile:* 71% (18–25 years), 16.1% (below 18 years), 12.9% (26–40 years), 0% (41–60 years)
- *Gender profile:* 61.3% female, 38.7% male, 0% other
- *Residential profile:* 64.5% urban, 22.6% rural, 12.9% semi-urban.

The higher number of young respondents (18–25 years) supports the online survey method, suggesting that the findings are likely to represent the views of educated youth.

Data Collection Instrument

A self-structured questionnaire consisting of 25 questions was developed for this study. The questions in the survey were structured into six thematic domains:

1. Demographic details (age, sex, residential area)
2. Sources of water and practices of treatment (source type, methods of purification, and maintenance of storage)
3. Knowledge of contaminants (biological, chemical, and physical)
4. Understanding of waterborne illnesses (identifying illnesses, ways they can be spread)
5. Knowledge regarding sanitation and waste disposal (proper waste disposal, sewage disposal)
6. Knowledge of hygiene and safe water practices (hygiene and safe water practices)

The questions took multiple-choice and yes/no questions to allow for quick answering and easier numerical evaluation. The questionnaire was done on Google Forms so the data collection was done automatically and the survey was easily distributed.

Collection of Data

The survey on Google Forms was distributed on social media (WhatsApp) and other online communication channels. The participants received information about the study, that it was voluntary and that their answers would be kept confidential. No identifying information was collected, so anonymity was kept. Responses were collected during the month of March 2026.

Analysis of Data

The analysis of the quantitative data was completed using Google Forms analytics and was supplemented with additional analysis. The frequencies of answers were calculated and reported for each question in percentages. The results were presented in pie charts and bar graphs to assist in the recognition of patterns and to facilitate comparison of different demographic groups. The analysis technique that was used to explain the results (percentages, distributions) was appropriate for the exploratory phase and the sample size of the study.

Considerations of Ethics

The study was done according to the most important ethical guidelines:

- Participation was voluntary, no one was forced to take part and no one was given incentives.
- *An informed consent:* The participants were informed about the study, including the its objectives and the procedure.
- *Anonymity:* None of the participants were asked for personal information.
- *Confidentiality:* The responses were kept securely, and were reported in totals.
- *Beneficence:* The potential knowledge to be gained from this study will be of benefit to the field of public health.

Limitations

The following limitations have been identified and should be acknowledged:

1. *Size of the sample:* The relatively small sample size (n=31) limits the ability to generalize and lowers the potential statistical power.
2. *Sampling Bias:* The use of convenience sampling, as well as the online survey, may exclude certain groups of people who have a low level of internet access or digital literacy.
3. *Age Skew:* A larger proportion of younger respondents (18–25 years) suggests the possibility of a lack of representation of the views of the general population.
4. *Self-Reporting Bias:* The responses to the survey may be subject to the social desirability phenomenon, as well as inaccurate recollection.

5. *Cross-Sectional Design:* Due to the nature of the study, it will not be able to identify the causes of a specific phenomenon, or the order of certain events.

The study may have these limitations; however, it still offers good quality information about the patterns of awareness of the respondents as well as the potential of the study in determining the areas of intervention.

RESULTS

Demographics

In Table 1, the demographics of the respondents to the survey display certain significant patterns that influence the interpretation of the study. A majority 71% of the participants were in the 18–25 years old category, which is part of the young adult age group that is likely to use the internet frequently. The results of the survey were also relatively balanced in terms of gender, with 61.3% of the respondents being female, and 38.7% as male.

Residential distribution showed urban dominance (64.5%), while contributions from rural (22.6%) and semi-urban (12.9%) areas were comparatively smaller.

Water source distribution revealed that 54.8% of households depend on municipal supply, 35.5% on tanker water, and 9.7% on packaged water. The substantial reliance on tanker water (over one-third of respondents) suggests inadequacies in piped water infrastructure even among the predominantly urban sample.

Awareness of Water Contamination and Disease Causation

In Table 2, the survey showed various levels of awareness about water contamination, specifically about water contamination as a disease vector. When asked if water contamination causes diseases, 87.1% confidently answered yes, 9.7% said maybe, and 3.2% said no. Almost everyone identifying water contamination as a cause of disease demonstrates adequate knowledge.

Table 1. Demographic characteristics and water source distribution of survey respondents (N=31)

Demographic Variable	Category	Percentage (%)
Age Group	Below 18 years	16.1
	18-25 years	71.0
	26-40 years	12.9
	41-60 years	0.0
Gender	Female	61.3
	Male	38.7
	Other	0.0
Residential Area	Urban	64.5
	Rural	22.6
	Semi-urban	12.9
Water Source	Municipal supply	54.8
	Tanker water	35.5
	Packaged water	9.7

Table 2. Summary of awareness levels regarding water contamination and disease causation (N=31).

Knowledge Item	Correct Response	Percentage (%)
Contaminated water causes disease	Yes	87.1

Sources of infection (multiple)	All of the above	87.1
Common waterborne diseases	All of the above	77.4
Microorganisms in untreated water	Yes	100.0
Improper waste disposal increases risk	Yes	96.8
Biological contamination agent	*E. coli*	64.5
Cholera causative agent	*Vibrio cholerae*	83.9
Chemical contamination source	Industrial waste	93.5
Heavy metals classification	Chemical	48.4
Protozoan disease	Amoebiasis	61.3

Most of respondents (87.1%) answered, "all of the above" (including contaminated water, unwashed hands, open garbage, and sick people) when asked about the sources of infections. Only 12.9% answered contaminated water, showing that most understand the problem of multiple causation. 77.4% of respondents answered "all of the above" (cholera, typhoid, diarrhea, hepatitis A) showing equally high awareness of waterborne diseases as others, while 16.1% only named cholera and 6.5% only named diarrhea. No one named typhoid, despite it being a common contender for water contamination in India.

A major positive finding is that most people, close to 100%, recognize the biological agents that contaminate water. This high awareness lays the ground for reinforcing the practice of water treatment.

The vast majority (96.8%) of respondents said that proper disposal of waste is important to prevent infections while 3.2% were unsure, and none disagreed. This shows a good grasp of the relationship between sanitation and the prevention of disease.

Knowing the Factors of Contamination

Responses to the survey questions pertaining to knowledge of the biological and chemical agents of contamination showed varying levels of understanding. Of the respondents, 64.5% identified *E. coli* as a biological contaminant, while 19.4%, 12.9%, and 3.2% chose mercury, lead, and nitrates, respectively. The large recognition of *E. coli* corresponds to its prominence as the fecal indicator organism. For a causative agent of cholera, 83.9% correctly cited *Vibrio cholerae*, which shows strong disease-specific microbiological knowledge. Those who cited false agents of cholera included *Salmonella typhi*, who is the agent of typhoid fever, and, therefore, is a plankton vector of malaria, and *Staphylococcus aureus*, who is known to be a food poisoning bacterium but is not waterborne.

Knowledge about chemical contamination showed more uncertainty. Of the respondents, 93.5% identified the primary source of chemical contamination as industrial waste discharge, and this shows good knowledge of industrial chemical contamination. The classification of heavy metals (arsenic and lead) showed mixed responses, with 48.4% correctly identifying them as chemical contaminants, while 45.2% incorrectly classified them as physical contaminants, and 6.5% as biological contaminants. This ambiguity demonstrates the need for further education on the classification of contaminants.

Regarding contamination of protozoans, 61.3% answered correctly that amebiasis is caused by protozoan parasites, while 22.6% and 16.1% incorrectly chose cholera and hepatitis A, respectively (both of which are caused by bacteria and viruses).

Transmission Modes and Hygiene Practices

Infection transmission modes show thorough understanding. When asked infection spread, 67.7% chose "all of the above" (including air, direct, food/water, and vector), while 32.3% picked food and water. No participant chose single modes in order, indicating recognition of multiple transmission pathways. Self-assessed hygiene behavior show largely positive engagement. Before meals, 80.6% hand washing "always" was reported, while 19.4% chose "sometimes." No one chose "rarely" or

"never." High hand hygiene compliance is an important protective behavior. Most participants reported washing fruits and vegetables before eating them, although the washing of certain fruits and vegetables was not tabulated. Nearly all participants were aware of and recognized the vector-borne transmission of disease-causing flies. The educated, urban-dominated sample is the context in which the knowledge is being implemented. High protective behavior rates and solid knowledge about vectors confirms this positive behavior change. However, the 80.6% "always" compliance gap leaves clear behavior change needed in hand washing.

Practices in Water Treatment and Purification

Diverse methods for ensuring the safety of drinking water show variability among participants regarding home water treatment. In Table 3, the Participants mentioned various methods of purification, and their answers spanned across different methods. For some, boiling was their answer (48.4%). While 25.8% used reverse osmosis (RO) systems, 22.6% used water filters, and a few used no extra treatment at all, relying just on the municipal supply. The high percentage of boiling water shows a result of its low cost and ease of use, as no special equipment is needed other than a heat source. Also, boiling water is a good option to kill microbes. The 25.8% of people using RO systems is a large percentage, and shows some degree of economic status, as they are expensive. 48.4% of participants knew that chlorination was the best way to kill microorganisms, while 41.9% thought it was filtration and 9.7% believed it was sedimentation. Both filtration and chlorination are used in municipal water treatments, so the participants are correct in their assumption that a combination of several methods is effective and necessary. However, chlorination is the standard method of treatment. Most participants showed good awareness of municipal water treatment, as it is a widespread fact that water is treated, and participants used additional methods to treat the water. This shows a distrust of municipal water, and in fact, many know that water is contaminated during the distribution process after treatment.

Water Storage and Infrastructure Concerns

Here, concerns over the gaps in the water storage tank maintenance practices are understandable. There was a considerable span in the intervals of tank cleaning. While 38.7% stated cleaning was done every 3–6 months, 16.1% said it was done monthly, 22.6% said it was done yearly, and 22.6% didn't know when their tank was cleaned last. Those who clean their tank annually, or don't know when their tank is cleaned last, pose a substantial risk for contamination, since water that is stagnant and uncleaned for a year or longer, can cause the development of biofilm and the proliferation of pathogens. The risk of contamination due to old and leaking pipes is common knowledge, and it almost unanimous as 87.1%

Table 3. Water treatment practices and infrastructure-related awareness (N=31).

Demographic Variable	Category	Percentage (%)
Age Group	Below 18 years	16.1
	18-25 years	71.0
	26-40 years	12.9
	41-60 years	0.0
Gender	Female	61.3
	Male	38.7
	Other	0.0
Residential Area	Urban	64.5
	Rural	22.6
	Semi-urban	12.9
Water Source	Municipal supply	54.8
	Tanker water	35.5
	Packaged water	9.7

of the participants agreed. This concern of contamination due to old leaking pipes and their point of use

taps has been the focus of recent news reports addressing this problem in Indian cities. The major urban-

Waste Disposal Practices

Several strengths and weaknesses were found among the various practices for managing waste. Due to most of participants living in an urban area, most participants showed reliance on municipal waste collection systems. However, even with the small percentage that stated practicing open dumping or burning, this is a highly irresponsible, environmentally damaging, and vector breeding practice. A significant weakness with the practice of waste segregation was that only 50% of participants stated that they practiced waste segregation. Considering the education in the group, this is an incredibly low number for someone to see the opportunities that can be fully utilized to prosper in waste management and recycling. Consistent with past studies, participants understood the link between water resource contamination and waste disposal. Alighan (2020) explains the correlation between the awareness of improper disposal of waste and on the increased spread of infections (96.8%). This implies that the awareness alone does not bring about comprehensive waste management.

Preventative Measures

54.8% believe that the most important method in preventing water contamination is to boil the water. 19.4% believe that the most important method is to eliminate waste. 16.1% and 9.7% believe that the most important method is to practice safe water disposal. With the most participants believing that boiling water is the most important method to eliminate water contaminants, that act is the most individualized and direct method they could do.

Community center with systematic measures should not be undervalued in their impact. As highlighted in the study, very few participants believe that centralized waste disposal is an effective method to eliminate contaminants in water. This pattern may indicate preference for individual agency and immediate actions as opposed to long-term systemic considerations. All respondents said ideal features of safe drinking water and, without exception, said safe water is and should be “colorless, odorless, and free from pathogens”; rather than describing water with unacceptable levels of contamination.

Findings Summary

There is a segment of the population that has high knowledge of the risks associated with water contamination, how people may contract diseases due to water contamination and basic measures to prevent these diseases. Strengths:

- Infection related to water contamination is universally accepted.
- Knowledge of disease sources and their modes of transmission is widespread.
- Basic hygiene practice is high (80.6% wash before meals)
- Water treatment (boiling, RO, filtration) is practiced by a large majority.
- The relationship between water and sewage is understood.

Some knowledge and practices that need to be improved include:

- Management of water storage tanks is not regular (44.8% Unknown or yearly)
- Waste segregation has not reached above 50%.
- People may confuse the concepts of chemical and physical contamination.
- People may put less value in systemic sanitation than individual actions.

DISCUSSION

Evaluating Awareness

The presence of high awareness in this study (87.1% of the population are aware of the diseases associated with water and 100% aware of microorganisms in untreated water) is a finding that exceeds general population knowledge. A successful penetration of the public health messaging was received, attributed to several variables including, media exposure of contamination incidents, formal education,

and public health related education campaigns. The public awareness of the safety of the water was likely affected by the contamination incidents that occurred in 2024–2026 in the major cities in India. This explains the heightened awareness. The media coverage of the deaths in Indore, the typhoid outbreaks in Gandhinagar, and the sick clusters in Bengaluru focused the country's attention to water contamination. It was likely the contaminated water that contributed to the survey. The sample is highly skewed demographically, sample consists of young people, aged 18–25 (71%), and people who live in urban (64.5%) areas. This sample also consists of people who can easily access the survey online. Therefore, the small sample size and the awareness of the participants is not a good representation of the whole population. The people who live in the rural areas, the older people, and the people who have less access to education will have a knowledge profile that is likely to be different. Significant rural-urban splits in knowledge and practices have previously been documented [17-18].

Multi-Barrier Approach to Water Safety

The extensive home water treatment with boiling, reverse osmosis, or filtration has been reported to 96.8% in a multi-barrier approach to water safety and has proven to be a rational method to manage the uncertainty of municipal water offered due to documented weaknesses in the water supply infrastructure. However, it does not replace the need to provide safe water at the tap. Odisha's "Drink from Tap" program shows that a sustained, pressurized water supply can positively influence public perception and behavior. Where the municipal water supply is safe, the burden of household water treatment decreases, the boils safety of the water supply, and the social equity of water supply as it is economically disadvantaged households that lack the means to obtain reverse osmosis systems or bottled water. A concern for water tanker use has been reported in 35.5% of households as this statistically depicts an absence of safe or treated water, unhealthy storage conditions, and economically inequitable access to safe water. This reliance indicates urgent policy needs to address fundamental problems in piped water infrastructure.

Waste Management and Environmental Contamination

Despite the availability of knowledge on the association between waste disposal and the potential for infection spread in the community, the limited practice of waste segregation (50%) reflects potential for some of the challenges within the Indian context [19]. Successful waste segregation is achievable by:

- Adopting uncomplicated classification of waste.
- Providing infrastructure for the separate collection of wastes.
- Implementing regulatory frameworks paired with community cooperation.
- Ensuring the downstream treatment capabilities exist for the separated waste.
- Engaging in visible benefits that are sustained to reinforce the behavior.

The progress made by Swachh Bharat Mission (Clean India Campaign) towards constructing toilets and eliminating open defecation is notable, but in solid waste management, the case is opposite. This is true especially for fast-growing urban areas. As these places expand, the amount of waste produced continues and this outstrips the waste collection and processing capabilities. Even open dumping and burning of waste, even by a small percentage, poses a huge environmental and public health hazard in the form of attracting disease-carrying rodents, polluted air and water, and contaminated water [20]. So, the priority in waste management is still on open dumps and how these can be transitioned to scientific, sanitary landfills with proper leachate and methane management.

Priorities In Strategies for Prevention

Personal prevention through the boiling of water (54.8%) shows an individual level prevention bias, and this is also the case for the other listed prevention approaches. In public health, an even reverse order is valid [21]. Depending on the case, the base of open defecation, where the removal of fecal materials is the priority, is the ideal point to institute proper sanitation.

This established pattern suggests that health education be guided to focus on:

1. The idea of barriers and how multiple approaches are necessary.
2. The need to incorporate community-wide and policy-focused approaches.
3. Primary prevention, that is, from the source to the point of treatment (tertiary) to deflect disease.
4. The concept of collective action for reinforced infrastructure.

Behavior, in health, is recognized at multiple levels by the Socio-Ecological Model. This model shows that socially, communicationally, organizationally, and policy-wise, the individual is at the center of these interactions [22].

Simultaneous action at each of the levels is required to ensure water safety.

CONCLUSION

The population seems to know the effects of water contamination and how to prevent water contamination, but the population lacks a lot of knowledge in some of the water safety access systems and the practical implementation of these systems. There is a lot of awareness regarding water contamination and the dangers of microbial contamination and the risk of waterborne illnesses. However, water maintenance is poor and the segregation of wastes is insufficient. There is a missing behavioral system which is an aged system. There is also a lack of regulation and control, a limited water supply and a lack of resources. Recent water contamination outbreaks in India indicate a need of the system for water safety. Water safety can be improved by using a modern, comprehensive, cheap, and usable systems. Water safety can also be improved by using an educational and participative approach, regulating the supply of water, using cheap and usable systems, and modern and comprehensive systems for protecting, treating, and managing water. Public health systems claim that water safety, sanitation, and hygiene systems are very effective in controlling and preventing the death of millions of people in the world. To reach this aim, there needs to be continual policy commitment, financial backing, innovation, and community involvement. Making sure that everyone can access safe drinking water is a public health priority. It is also a fundamental human right that is essential for sustainable development and the social wellbeing of communities.

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